PROFESSIONAL AND PERSONAL CHARACTERISTICS OF COMPUTER PROGRAMMERS WHO ARE LEGALLY BLIND

by

Lyle Knowles

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PROFESSIONAL AND PERSONAL CHARACTERISTICS OF COMPUTER PROGRAMMERS WHO ARE LEGALLY BLIND

by

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PROFESSIONAL AND PERSONAL CHARACTERISTICS OF COMPUTER PROGRAMMERS WHO ARE LEGALLY BLIND

Increasing numbers of individuals who are legally blind are currently working in the area of electronic data processing across the country. Others are being trained for this work.

Having instructed three such individuals who are presently working in the computer field, this writer found a lack of significant feedback from programmers who had received computer training and were employed in some phase of the industry.

In an effort to meet this need, a questionnaire of some thirty-seven items was constructed and distributed in January 1966. A total of thirty blind programmers responded.

The data were analyzed, and a recapitulation of the results appears as the attached chapter of a Master's Thesis made possible through the questionnaire responses. The entire thesis may be obtained through the inter-library loan medium from the University of Southern California Library.

It is hoped that this pilot study might serve as a prelude to a more comprehensive study of blind computer programmers. A thorough investigation, much like the monumental work of Mary K. Bauman and Norman Yoder's 1960 report

of blind professional people, is greatly needed.

The attached results may be of some interest to training centers, rehabilitation personnel, and other concerned parties. This writer is aware that the small sample investigated may not be precisely representative of the blind computer programmer population at large, but the general patterns reflected by the data might be indicative of broad characteristics and trends existing in the field.

CHAPTER IV

PRESENTATION AND DESCRIPTIVE ANALYSIS OF THE DATA

This chapter provides a presentation of data collected, and an analysis of these data directed toward a description of the sample population. Objectives delineated in Chapter I are discussed with the exception of objective seven, which is examined in Chapter V.

Topics discussed in this chapter are in terms of the thirty blind programmers who responded to the questionnaire.

JOB DESCRIPTION

Type of work

As described in Chapter I, the duties of a computer programmer were divided into nine separate phases. Table 3 reflects the estimated amount of time devoted to each of these phases or stages. The first column indicates the phase; the second column, the number of men responding to that phase; the third column, the mean time devoted to that area of programming.

According to the table, the four areas requiring most of the time of these programmers are: problem defining, planning of logic, coding of instructions, and debugging. These four phases absorb a total of 72 per cent, or approximately three-fourths of the programmer's day.

TABLE 3

ESTIMATED PER CENT OF TIME DEVOTED TO VARIOUS PHASES OF COMPUTER PROGRAMMING

Phase of Programming	Number of Responses	Time in Per Cent
Problem defining	24	16
Planning of logic	27	19
Flow charting	18	11
Coding of instructions	27	22
Keypunching	19	7
Proofreading program cards	22	5
Debugging	27	15
Finalizing	21	8
Documenting	25	8

By examining the frequency of response to these four items, in most cases, 90 per cent of the programmers involved devote time toward these phases of work.

Little time appears to be spent keypunching and proofreading cards. In considering flow charting, twelve men, or 40 per cent, indicated they did not do flow charting as such.

The fact that none of the items in the question under discussion received thirty responses is clarified by realizing that five individuals were involved in systems level work, supervision, or planning, and four others were university teachers in the area of data processing.

Types of programs

Tables 4, 5, and 6 summarize types of programming languages used, length of programs, and per cent of time devoted to various types of programs.

TABLE 4

ESTIMATED PER CENT OF TIME DEVOTED TO VARIOUS PROGRAMMING LANGUAGES

Type of Language	Number of Responses	Time in Per Cent
Machine language or absolute	12	10
Symbolic or assembly language	24	38
Semi-symbolic such as Autocoder	11	65
FORTRAN	14	32
COBOL	5	43
Other compiler language	6	49
Other language	3	13

TABLE 5

APPROXIMATE LENGTH OF PROGRAMS OF VARIOUS PROGRAMMING LANGUAGES

Level of Language	Mean Number of Statements	Modal Number of Statements
Machine language	70	50
Symbolic language	650	100
Compiler language	170	200

TABLE 6

ESTIMATED PER CENT OF TIME DEVOTED
TO VARIOUS TYPES OF PROGRAMS

Type of Program	Number of Responses	Time In Per Cent
Short symbolic	19	26
Long symbolic	17	42
Short compiler	15	31
Long compiler	12	47
System modification	7	22
Other	3	15

Table 4 shows twenty-four or 80 per cent of the group working at the symbolic or assembly language level. From these twenty-four individuals, it was found that approximately 38 per cent of their time was given to writing programs at the symbolic level.

Although only eleven programmers reported to be writing in a semi-symbolic language such as Autocoder, 65 per cent of their time was absorbed in developing these programs.

The symbolic and semi-symbolic programmers reported an average program length of 650 statements or instructions.

Machine language coding was being performed by twelve men. The number of instructions per program as reflected by Table 5 shows a mean of 70 and a mode of 50. Two programmers were involved with new machines, and were developing software routines which required several hundred machine language instructions.

Fourteen individuals indicated use of FORTRAN, with fewer using other compiler level languages. Table 5 shows a mean of 170 and a mode of 200 statements per compiler language program.

The wide difference between the mean and mode of symbolic program instructions shown by Table 5 is again due to software programmers, four of whom reported routines from 1000 to 4000 statements.

A slightly different approach to the descriptions of efforts in the programming area is reflected by Table 6. A direct separation according to level and length is given. The most significant aspect of this table is the pattern existing in time devoted to long and short types of programs, such that more time is afforded longer programs.

The last item in Tables 4 and 6 indicates "Other language" and "Other" respectively, to which three individuals responded. In the remarks section of the questionnaire, these men described their work as highly specialized, mainly in the developmental aspects of systems.

Applications areas

A greater number of programmers were involved with business applications than with other areas as shown in Table 7. The scientific, engineering, and mathematical fields had absorbed about one-third of the group.

The first of two interesting features of Table 7 is that eight individuals selected "Other" as a response, and devoted almost three-fourths of their time to that application area. As found in other tables, there is a small number of men within the sampled group who are highly specialized. They reported working in research and

development, systems programming, teaching, and teleprocessing.

TABLE 7

ESTIMATED PER CENT OF TIME DEVOTED TO VARIOUS APPLICATIONS AREAS

Type of Application	Number of Responses	Time in Per Cent
Business general	13	48
Business accounting	7	33
Business analysis	15	32
Scientific	11	44
Engineering	6	41
Statistical	8	22
Mathematical	8	29
Other	8	73

The second item of interest is somewhat the inverse of the first, in that there is generally a lack of extreme specialization within the group as a whole. No applications are received more than 48 per cent of the programmers' time, which is possibly indicative of diversification and flexibility in background and experience of the group.

It is noted that perhaps the least significant area is that of statistics, a relatively new field of applications in the data processing industry.

General job characteristics

According to professional men interviewed by Bauman and

Yoder ~~(2)~~, a blind person will probably spend more than the normal forty hours per week if he expects to enjoy any degree of success, and the group of programmers involved in this study appear to be no exception. Table 8 indicates number of hours per week devoted to work, both on the job and at home.

TABLE 8

HOURS WORKED PER WEEK

Number of Hours	Number of Responses
Less than 30	0
30 to 40	4
40 to 50	15
50 to 60	3
Over 60	4

Several individuals reported that they were graduate students and were working part time as computer programmers. However, no one worked less than 30 hours per week. Half of the group worked 40 to 50 hours, several worked 50 to 60 hours, and four individuals devoted more than 60 hours per week to their job.

The modal response to per cent of time spent coordinating with other programmers as opposed to working independently was ten per cent while six men reported five per cent. Teachers and members of systems groups spent most of their time in coordination or supervisory activities, which would make the computation of a mean percentage time invalid for the group as a whole.

Seventeen programmers reported they never operated the computer. The range for per cent of time given to computer operation was from zero to 30 per cent, with a mean of seven per cent.

Methods used to remain current on activities within the industry are shown in Table 9. All respondents indicated they utilized discussions with other programmers, and this method was favored over others, since eight selected it as their first choice of methods, and sixteen made it their second choice. Half of the group made use of available tape recorded material, but only two indicated this was their favorite means.

TABLE 9

MEANS USED TO REMAIN CURRENT ON ACTIVITIES WITHIN THE INDUSTRY

Method Utilized	Number of Responses	First Choice	Second Choice
Available brailled material	10	1	1
Tape recorded material	15	2	3
Hired reader	11	7	1
Relative or friend who reads	12	5	0
Discussions with other programmers	30	8	16
Classes at a university	6	0	1
Classes given by industry	16	1	6
Can read material myself	5	0	0
Other	4	2	1

Over half of the group had attended classes provided by industry, but this method appeared to lack popularity as did university

classes.

"A hired reader" or "A relative or friend who reads," were selected as first choices by 40 per cent of the group.

Although five respondents could read print with the aid of a magnifying device, it was not a preferred method.

Types of computers

A wide variety of computers worked with was reported as summarized in Table 10.

TABLE 10

TYPES OF COMPUTERS USED BY PROGRAMMERS

Type of Computer	Number of Responses
IBM 1401	23
IBM 1620	11
IBM 650	2
IBM 7040	8
IBM 7094	17
IBM 7074	2
IBM 709	4
IBM 1460	2
IBM 1410	3
IBM SYS 360	6
CDC 1604 A	1
PHILCO 2000	2
HONEYWELL 200	5
HONEYWELL 400	5
HONEYWELL 800	4
RCA 301	3
RCA 501	1

The machine most frequently mentioned was the IBM 1401, a small to medium sized computer, used primarily for business applications, or as an input-output media for larger 7000 series IBM systems. As indicated in Chapter II, the IBM 1401 is used at the Medical Computing Center, University of Cincinnati to train blind programmers.

The second choice was the IBM 7094, a large sized computer system utilized in scientific and some business applications.

Several custom built computers were reported, primarily from programmers working in research and development functions.

FEELINGS AND ATTITUDES ABOUT WORK

Job satisfaction

All programmers responding to item 20 on the questionnaire indicated their feelings of job satisfaction to be "Satisfactory" or above. Nine responded "Very satisfactory," ten reported "Satisfying."

When asked if they would still enter the computer field if they were selecting a career, twenty-seven or 90 per cent said "yes," and two said "no."

When asked if they would encourage other qualified blind people to enter the programming field, twenty-eight said "yes," and two said "no."

Table II illustrates feelings about job security. Approximately one-half of the sample felt "Very secure" in their present position. The one individual who felt "Not secure at all" in his job, although his work was "Very satisfying" to him, also said he would not enter the field again if he had a choice, and would not encourage

anyone else to enter it either.

TABLE 11

FEELINGS ABOUT JOB SECURITY

Attitude	Number of Responses
Very secure	14
Fairly secure	3
Secure enough	4
Not too secure	4
Not secure at all	1

When asked about work load, sixty per cent said requirements placed on them to produce results were "About right." Table 12 shows over-all response to this question, with only one man feeling he had "Far too much work" to accomplish.

TABLE 12

FEELINGS ABOUT WORK LOAD

Attitude	Number of Responses
Far too much work	1
A little too much work	4
About right	18
Too little	0
Much too little	3

In comparing Table 12 with Table 8 on hours devoted to work each week, it appears that most programmers are willing to put forth the extra time required to get the job done without feeling overburdened.

Ten per cent of the group thought they had "Much too little" work assigned to them.

Feelings on type of work

The following topic concerns itself with further responses to questions about the nine stages of computer programming established in Chapter 1.

Table 13 reflects definite feelings from the group about the types of work preferred in developing and completing a program. Twenty-four or 80 per cent chose problem defining and planning of logic as "Most preferred" areas, with coding of instructions as second most favored.

Keypunching and proofreading program cards received no responses, which was verified by the "Least preferred" column showing most of the group liked doing this task least.

About one-half of the group liked debugging, or correcting of an already written program, and one-half did not like it at all.

Everyone appeared to like the primarily mental oriented phases of problem defining, planning of logic, and coding. The two latter areas are often individual endeavors, requiring independent action on the part of the programmer.

Approximately one-third of the sample indicated "Least

preferred" when asked about flow charting and documenting.

TABLE 13

AREAS OF PROGRAMMING PREFERRED
OR NOT PREFERRED FOR WORK

Phase of Programming	Number of Responses*	
	Most Preferred	Least Preferred
Problem defining	24	0
Planning of logic	24	0
Flow charting	6	8
Coding of instructions	16	1
Keypunching	0	23
Proofreading program cards	0	23
Debugging	13	13
Finalizing	0	4
Documenting	4	12

*Programmers were asked to choose three items in each case.

Feelings on proficiency and improvement

Table 14 gives a summary of feelings about proficiency, areas of difficulty, and feelings on improvement. Almost 90 per cent of the group felt they were most proficient in logic and coding, which corresponds with Table 13 giving preferred areas of work. Problem defining and debugging follow somewhat the same pattern.

TABLE 14

FEELINGS ABOUT PROFICIENCY AND IMPROVEMENT IN AREAS OF PROGRAMMING

Phase of Programming	Number of Responses*			
	Most Proficient	Least Proficient	Most Difficult	Would like to Improve Most
Problem defining	14	4	9	18
Planning of logic	25	1	1	7
Flow charting	7	13	12	8
Coding of instructions	22	2	4	2
Keypunching	1	24	15	11
Proofreading program cards	0	17	18	9
Debugging	14	12	14	15
Finalizing	1	5	3	3
Documenting	3	9	9	14

*Programmers were asked to choose three items in each case.

A lack of proficiency is evidenced by the first two columns in Table 14 in the areas of keypunching and proofreading program cards. Both of these areas normally require a sighted person. Recording of data into cards, and verification of this information is recognized as the crucial, "bottleneck" phase of data processing throughout the industry. It would be expected that these two areas would be difficult

for a blind person, as shown in the third column of Table 14. The fourth column in the table reflects a willingness on the part of many to work toward improvement in these areas. Some proposed solutions to this problem are discussed under the topic "Aids and Devices" in this chapter.

Flow charting and debugging may also require use of special aids on the part of the blind programmer. Lack of proficiency and difficulty with these two facets of programming are illustrated by the second and third columns of Table 14, where almost half of the sample indicated these as problem areas. Twelve of those who reported debugging as being "Most difficult" said they would like to improve in this area.

The phase selected most often for improvement was that of "Problem defining." It was also a "Most preferred" area, and a "Most proficient" area. Within the hierarchy of positions existing throughout the data processing industry, the "problem definer," sometimes titled "System Analyst," ranks toward the top end of the scale. He is often an organizer, definer, supervisor type of individual. According to the pattern of responses of the sample, the modal blind programmer is looking toward the future.

Preferences of programming languages

Two-thirds of the group chose the symbolic or assembly language level of programming as a preference over other types, as shown in Table 15. About one-third selected semi-symbolic, such as Autocoder, and one-third chose FORTRAN as a favored language.

TABLE 15

PREFERENCES OF PROGRAMMING LANGUAGES

Type of Language	Number of Responses*
Machine language	6
Symbolic/assembly	20
Semi-symbolic	11
FORTRAN	10
COBOL	4
Other compiler	4
Other language	2

*Respondents were asked to select two choices.

Again, individuals indicating "Other" languages were primarily involved in research and development.

Comparing Table 15 with Table 7, showing applications areas, it appears that the business oriented programmers may be writing most of their programs at the symbolic language level rather than using COBOL.

AIDS AND DEVICES

As Mary K. Bauman (1) indicates in her studies on the blind professional person, special aids and devices are often used to compensate for lack of sight. Many such devices for the blind programmer have grown out of Theodor Sterling's training center at the University of Cincinnati, and were discussed in Chapter II in terms of their use

as educational aids. This section discusses how many of these devices are being utilized in the field by professional programmers.

Planning and coding phases

According to Table 16, almost two-thirds of the programmers plan their programs in braille. Many reported that they use a pattern of symbols approximating the FORTRAN programming language in their planning, somewhat like the sighted programmer might use a flow chart. Eleven men indicated they did not do flow charting as such, but often used the previously described method.

TABLE 16

DEVICES USED IN LOGIC OR FLOW CHARTING PHASES

Type of Device	Number of Responses
Planning of logic in braille	18
Flow chart in braille	8
Flow of logic on brailled punch cards	8
Brailled flow chart printer output (computer program)	1
Typed version of flow of logic drawn up by an assistant in standard flow chart form	3
Tape recorded version drawn up by an assistant	2
Do not do flow charting as such	11
Other	11

Eight men utilized the convenience of the standard 5081 punch card by coding brailled instructions on them and placing them in order according to the structure of the program logic.

Five individuals were helped by sighted assistants who worked from a typed version or recorded description of the flow chart.

About one-third of the programmers described devices or uses of devices they had developed to overcome the problem of communication in this area. Such approaches as recording a preliminary outline of program logic onto recording tape and playing it back were often mentioned. Foot controls on recorders, freeing the programmer to make braille notes on the logic, were used by several men.

In the coding stage, where the programmer translates his planning of logic into a programming language, braille was again the most used medium. Brailling instructions by use of a Perkins Braille Writer or slate and stylus is equivalent to the sighted programmer using a code sheet and pencil.

A summary of devices used in the coding phase is given in Table 17. Two-thirds of the sample used braille at this stage. About half keypunched their own programs, and the other half typed or wrote their programs for keypunching by an operator.

Other devices, such as a foot controlled tape recorder used by the programmer at the key punch, were mentioned as "Other" choices.

TABLE 17

DEVICES USED IN CODING PHASE

Type of Device	Number of Responses
Brailled version	20
Tape recorded version for key punch operator	6
Keypunch own programs	14
Typed version for key punch operator	11
Handwritten script version for key punch operator	5
Other	6

Working with computer output.

Several media may be used by a programmer to utilize computer output. Approximately two-thirds of the programmers in the sample are evidently using BLYNSYS as described in Chapter II, or some comparable translation system to convert information from computer storage configuration to braille, produced on a high-speed computer printer.

Eighty per cent of the programmers reported using an assistant to read output to them from time to time. Twelve men used punched cards as usable output, as shown in Table 18.

Several programmers indicated they did not use any form of braille output because they felt it was not necessary. They felt it was helpful during training, but somewhat tedious and time consuming to use on the job. They further said that once a programmer becomes

proficient in a language, he no longer needs braille output, but only the use of a secretary, clerk, or key punch operator, who could devote ten to fifteen minutes a day to the task of reading diagnostics and output data to the programmer. Over one-third of the group said they did not use braille output at all.

TABLE 18

DEVICES USED IN WORKING WITH COMPUTER OUTPUT

Type of Device	Number of Responses
Braille output from printer	19
Punched cards	12
Assistant reads printer output	24
Other	5

Brailled literature

Twenty-four men felt that brailled material was critically needed in the data processing industry. Many asked how they could find out what was available. There were also indications of willingness to share brailled documents and manuals with other programmers, a task currently being initiated by R. A. J. Gildea of RCA.

Several people did not respond to the question of brailled material since they were able to read print as discussed in a further section of this chapter.

SALARY AND LONGEVITY

Salary

Table 19 illustrates starting salaries of blind programmers, which runs generally from 1960 through 1964. A typical salary appears to be between $300 and $500 per month, of those programmers who responded to that item on the questionnaire. The range was from below $300 to $599.

TABLE 19

STARTING MONTHLY SALARY
AS A PROGRAMMER

Salary	Number of Responses
Below $300	3
$300 to $399	9
$400 to $499	7
$500 to $599	2
$600 or over	0

Current monthly salary of those men reporting varied greatly, and was, of course, influenced by time in the industry, type and amount of formal education, previous experience, and applications area. Table 20 reflects a bimodal distribution of salaries reported in 1965-1966, with peaks at the $400-$499 range and $800 or over range, which is probably most affected by longevity, presented as the next topic.

To afford an accurate evaluation of current salaries reported, factors such as time in the industry, previous experience, and educational background must be considered. Another influence on reported salaries is the fact that eleven men, for professional or personal reasons, preferred not to respond.

TABLE 20

CURRENT MONTHLY SALARY AS A PROGRAMMER FOR 1965-1966

Salary	Number of Responses
Below $400	3
$400 to $499	6
$500 to $599	2
$600 to $699	2
$700 to $799	1
$800 or over	5

As discussed in the following section, Table 22 indicates that half of the population sampled have been in the field less than two years, and may therefore be classified as "programmer trainee" or "junior programmer," whose positions and salaries will be well below those of a "programmer."

Length of time worked

Table 22 illustrates a bimodal distribution, which may be

related to the distribution of current salaries shown in Table 20. Of those reporting, twenty men had been employed less than three years, and ten had been involved with the computer industry for over four years.

Many of the first group are doubtlessly graduates of training programs discussed in Chapter II, while those with over four years experience are probably indicative of the type described by Bauman's studies.

Another twenty to thirty blind individuals have possibly entered the computer programming field since the distribution of the questionnaire, because training centers at the University of Cincinnati and University of Pittsburgh graduate students in the spring months.

TABLE 22

LENGTH OF TIME WORKED IN COMPUTER INDUSTRY

Length of Time	Number of Responses
Less than one year	8
One to 2 years	7
Two to 3 years	5
Three to 4 years	0
Four to 5 years	2
Over 5 years	8

DESCRIPTION OF THE POPULATION

Several items on the questionnaire pertained to personal and descriptive data about the group. Such topics as age, educational attainment, and characteristics of blindness are discussed in this section.

Age

As illustrated by Table 23, the range of ages for the group was from 21 years to 48 years. The modal age was 30 years, with a mean of 32.8 years. The median age was 31, and by examining the distribution, it might be said that most of the programmers sampled were men in their early thirties.

Education

All men were high school graduates, and as shown in Table 24,

90 per cent or twenty-seven were probably college graduates.

Most of those with an educational attainment of 19 years or above reported receiving a Ph.D., or were working toward it.

The mode in the years of education distribution was 16 years, or at the bachelor's degree level, and the distribution as a whole was skewed toward that area. The range was observed to be from 12 to 21 years.

TABLE 23

AGE OF BLIND COMPUTER PROGRAMMERS

Age In Years	Number of Responses
21	1
25	1
27	3
28	2
30	7
31	4
32	3
35	2
38	1
39	1
42	1
43	1
44	1
47	1
48	1

TABLE 24

EDUCATIONAL ATTAINMENT OF BLIND COMPUTER PROGRAMMERS

Years of Education	Number of Responses
12	3
16	13
17	5
18	1
19	4
20	3
21	1

Characteristics of blindness

The occurrence of blindness for the sample was generally between the time of birth to twenty years of age. The modal period, as illustrated in Table 25, was birth to ten years. Over 20 per cent were blind at birth.

TABLE 25

AGE OF OCCURRENCE OF BLINDNESS

Age	Number of Responses
At birth	7
Birth to 10 years	10
Ten to 20 years	8
Twenty to 30 years	3
Over 30 years	2

Over one-half the sample were totally blind, as shown in Table 26. Fifty-three per cent had total blindness compared with the current national figure of 24 per cent ~~(9:117)~~. Two men reported they could read print material with the aid of a magnifier, although they were classified as legally blind individuals.

TABLE 26

DEGREE OF BLINDNESS

Degree	Number of Responses
Total	16
Light perception	9
Travel vision	3
Can read print with magnifying device	2

Table 27 shows the type of travel assistance utilized by the sample. Eighty-three per cent, or twenty-five men reported they used a cane, which is illustrative of the independent character of the blind professional person described by Mary K. Bauman.

Of the respondents, none used a guide dog, although this writer personally is acquainted with two programmers who utilize this medium of assistance.

Twenty-two individuals indicated they corresponded with other blind programmers in the field, and many remarked that they would be in favor of some sort of formal communicative program, and would be willing to contribute to such an endeavor.

TABLE 27

TYPE OF TRAVEL ASSISTANCE USED

Type of Assistance	Number of Responses
Travel without aid	3
Cane	25
Guide dog	0
Sighted companion	4
Other	1

CONSTRUCT OF A TYPICAL BLIND COMPUTER PROGRAMMER

By examining the pattern of responses to the questionnaire, particularly as summarized in the tables of responses, a typical, or modal blind computer programmer can be constructed.

Personal characteristics

Such a programmer would be about thirty years of age, and a college graduate who has perhaps done some post graduate work. He would have become totally blind between birth and age ten, and now uses a cane for travel assistance.

Work

He has worked in the computer industry about two years, with a starting monthly salary of less than $400 and currently earns around $500 per month. His work week requires between 40 and 50 hours. He

feels very secure in his present position, and the work load is about right. He is happy he selected data processing for a career, and would encourage other qualified blind people to do the same. With an eye toward the future, he would like to work into a systems analyst position or a supervisory job.

Applications and programs

Most of his programs are written at the symbolic language level, and involve business applications. Each routine is several hundred statements in length, and he particularly enjoys the defining, logic, and coding phases, and, devoting about three-quarters of the time to them, feels proficient in these areas. He does not particularly like keypunching, proofreading punch cards, documenting or debugging, but would like to improve in these areas.

The computer installation where he works has a medium-sized computer with access to a larger system. The programmer does not operate the computer himself.

He spends about 10 per cent of his time coordinating with other programmers, who are a valuable source of current information on data processing. Other means used to keep abreast of the industry include tape recorded material and a relative or friend who reads. He feels braille documents are critically needed. He has taken classes provided by industry, but prefers other data gathering media.

In writing his program, he plans it in braille, and may code in braille or into a tape recorder to be used by himself or a key punch operator. Computer output occurs in braille, or is read by an

assistant if in print.

REMARKS

The "Remarks" section of the questionnaire provided valuable technical data and observations as described in the foregoing sections of this chapter. However, feelings and attitudes reflected by respondents were also most interesting.

In examining the comments made, the group must be described as enthusiastic, cooperative, intelligent, and exceedingly resourceful and self-reliant. Almost two-thirds of those responding wrote up to two pages of comments. About half either wrote personal letters or made telephone calls to inquire about the research.

Several individuals with the assistance of interested agencies are now establishing formal lines of communication among blind data processing people across the country.

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